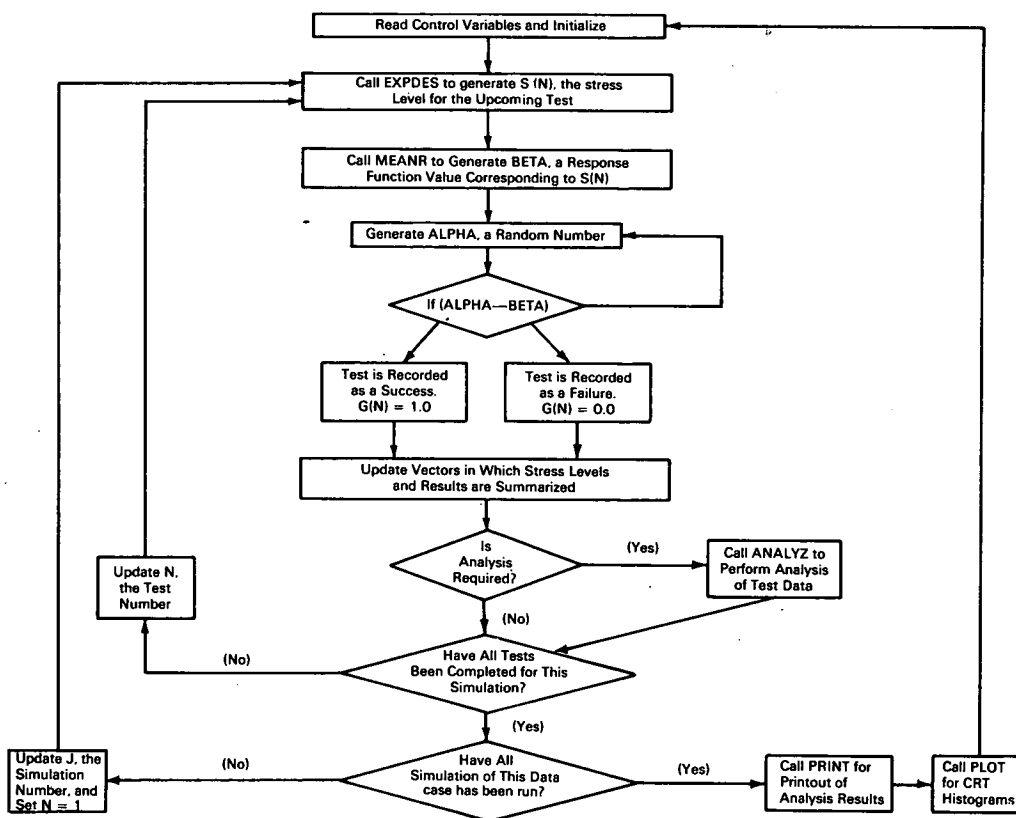


# NASA TECH BRIEF



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## Computer Program Simulates Design, Test, and Analysis Phases of Sensitivity Experiments



### The problem:

To devise a general purpose computer program for the simulation of the design, test and analysis phases of sensitivity experiments. Such simulation is currently accomplished with special purpose computer programs. These programs generally do not provide a wide range of design-response function combinations

and do not readily allow addition, deletion, or modification of subroutines to implement different types of designs.

### The solution:

A modular program consisting of a relatively small main program and a number of specialized subroutines. Three of the subroutines are essentially buffer

(continued overleaf)

routines used to call the specific routine required to implement the particular experimental design, response function, and analysis desired. Two utility subroutines handle the program output.

#### **How it's done:**

The desired experimental design, response function, and analysis procedures are specified by means of input control variables. The design routine is used to furnish a stress level for the first test and the corresponding response value is computed by the response function routine.

To introduce the randomness which characterized certain aspects of all tests, the response value is compared to a random number, uniformly distributed in [0, 1] and generated within the program. If the random number is greater than the response value, the test is recorded as a success. If, however, the random number is less than the response value, the test is a failure.

The stress value, the response, and whether the test was a success or a failure are stored in the core memory. Then the test number is updated and a new stress value is determined from the design function. The above cycle is then repeated and the information stored. This loop recurs until all the desired tests in the first simulation are performed. Then a second simulation is begun with the test number reset to one.

A maximum of 100 simulations, each consisting of up to 1024 tests, may be processed as a single data case. When these are completed, the results are all available in core storage. Then, for each simulation, estimates of the desired parameters are computed. Various characteristics of the response function can also be estimated, e.g., the stimulus levels corresponding to the 1% and 0.1% response levels or the mean and standard deviation of the distribution.

From these estimates the program then computes, over all simulations, the mean, median, standard error, maximum, and minimum values of each parameter estimate. These are then printed out in the analysis summary along with the true values of each parameter. When there are two parameters, their sample covariance matrix is also provided.

#### **Notes:**

1. This is a Fortran II program, coded for the IBM 7094.
2. This program has been used to simulate the Bartlett, run-down, 20 ZIL, block sequential, Alexander, and Rothman designs. Response functions which have been used in conjunction with these designs include the cumulative normal and cumulative uniform, those of Odell, and several special functions.
3. Maximum-likelihood estimation, predicted on the normal response function, and the method of reversals are the techniques of analysis which have received the most extensive use with this program.
4. Inquiries concerning this innovation may be directed to:

COSMIC  
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Athens, Georgia 30601  
Reference: B67-10077

#### **Patent status:**

No patent action is contemplated by NASA.

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